

Status of Main Injector Particle Production – *MIPP* – Experiment

Ed Hartouni



MINOS Group Meeting

CALTECH 1/3/02



November 2001 Fermilab PAC approval



Fermilab

November 8, 2001

Rajendran Raja
MS 122

Dear Raja,

Thank you for your presentation on P-907 at the recent meeting of the Physics Advisory Committee (PAC). The Committee had the following comments:

The program of P-907 is a broad one, including the measurement of particle production on NuMI targets, the test of scaling laws in high-energy particle production, and the exploration of a variety of phenomena in hadron-nucleus and proton-nucleus interactions. In the view of the Committee, the utility of the results of this experiment justifies its inclusion in the Laboratory's portfolio. The Committee deferred consideration of P-907 when the proposal was considered in November 2000, and asked for an enhanced proposal for this meeting. The critical issues which the Committee identified included the strength of the collaboration, sources of external funding, the schedule for installing and commissioning the detector and running the experiment, and clarification of the relevance of the experiment to MINOS. The Committee was pleased by the progress made by the collaboration in the past year. The Committee now believes that the collaboration has the personnel and resources to mount this experiment successfully. Most components (TPC, RICH, TOF, drift chambers, Cerenkov counters, calorimeter) are reused from decommissioned experiments, and external funding has been identified for most of the non-beamline project costs.

The experiment would run with proton intensities of 10^8 - 10^9 particles per spill, a small fraction of a booster batch. However, taking a conventional slow spill from the Main Injector would have an unacceptable impact on collider luminosity for Run II. To address this issue, the proponents have proposed a double slow spill scheme, which would allow a slow spill of a small number of protons without significantly compromising antiproton production. Although the Beams Division has endorsed as reasonable the principles underlying this scheme, it has not yet been shown to work in practice.

The Committee would like to see this experiment go forward, but it believes strongly that the highest priority of the Beams Division is Run II collider luminosity, including the commissioning of the Recycler. Implementing the double slow spill scheme is of a lower priority, and may not be achieved before 2003. In the period before this can be done, the experiment could run in a test beam mode, receiving the occasional conventional slow spill

from the Main Injector in such a manner as to have a minimal impact on Run II. Moreover, double slow spill running is incompatible with NuMI, so P-907 must either complete data taking before NuMI commissioning or return to a test beam mode at that time.

The Committee must assign this experiment a low priority within the Laboratory's program. No Laboratory funds will be available for building the experiment. The Committee notes that while the proponents have identified funding for construction, the budget which was presented contained no contingency. The Committee urges the collaboration to continue to develop new outside sources of funding.

With these constraints in mind, the Committee recommends Stage I approval.

I accept the Committee's recommendation and hereby grant Stage I approval to P-907. However, I also accept their constraints, namely, that the experiment has a low priority within the context of the overall Laboratory program, and that no Laboratory funds will be available for building the experiment. In addition, the experiment must not interfere with collider running. The next step is for you to develop a Memorandum of Understanding which will identify running conditions, manpower, funding sources, etc. Mike Shaevitz will provide you guidance in this effort.

Congratulations and good luck!

Sincerely,

Michael Witherell

cc: K. Stanfield
M. Shaevitz
S. Holmes
P. Meyers
M. Goldberg



Status of funding for E907



Understanding:

Accelerator & beamline up to MC7 is a Fermilab responsibility

Beamline & apparatus in MC7 is MIPP responsibility

FY01

Fermilab/SY120

\$250k LLNL

FY02

\$200k Fermilab/SY120

\$500k LLNL

DOE/DP Academic Alliance Program

FY03

Fermilab/SY120

\$500k LLNL

DOE/DP Academic Alliance Program

FY04

\$500k LLNL (if required)

DOE/DP Academic Alliance Program



Status of E907/MIPP installation



FY01

Beam

MI-TeVatron-switchyard beam connection

Apparatus

MC7 clean out

Magnet refurbishment

Shoring MBottom

FY02

Beam

Enclosure C

MC6 shield pile

Commission beam to Meson March 2002 (?)

Slow spill mode tests

Apparatus

Install Magnets

Complete modifications to MC7

Begin installation of detector elements

Engineering run Sept. 2002 (?)



Fermilab run schedule and proposed MIPP running



Fermilab Draft Schedule (9/29/01)												
Calendar Year	Booster Intensity $\times 10^{12}$	Main Injector Intensity $\times 10^{12}$	P-bar Source Stack Rate $\times 10^{10}/\text{hr}$	Tevatron Luminosity $\times 10^{32}$	integrated fb^{-1}/yr	CDF/D0	BTeV	MiniBooNE	NuMI/MINOS	KAMI/CKM	MIPP	Comments
2001	4.2 @ 1Hz $5 \times 10^{15}/\text{hr}$	3.5 @1.47 sec	10	0.3 (36x36)	0.3	Run IIa	R&D	Construction	Construction	Pre R&D PAC review	PAC approval	Left Bend Mods
September shutdown 2-3 weeks												
2002	5.0@6Hz $9 \times 10^{16}/\text{hr}$	4.5 @1.47 sec		0.8	0.8		Baseline Review	MiniBooNE data		R&D	Installation	Test Beams MI Slip stack TeV mods
August-September shutdown 8 weeks												
2003	5.0@7Hz $1 \times 10^{17}/\text{hr}$	9.0 @1.60 sec		1.2 (103x140)	1.2					Baseline Review		132 ns
September shutdown 4 weeks												
2004	5.0@7Hz $1 \times 10^{17}/\text{hr}$	9.0 @1.60sec		2.0	0.8		Construction					G-2 Right Bend Mods KAMI Test Beams
6 month shutdown, Electron cooling, Silicon Detector Replacement												
2005	5.0@8Hz $1.2 \times 10^{17}/\text{hr}$	3.5 @1.87 sec		4.0	3.25	Run IIb		BooNE Data				
September shutdown 4 weeks												
2006	5.0@8Hz $1.2 \times 10^{17}/\text{hr}$	3.5 @1.87 sec		5.0	4.4					Low E Data	Construction	Mixed Mode (NuMI&Collider)
September shutdown 4 weeks												
2007	5.0@3Hz $5 \times 10^{15}/\text{hr}$	3.5 @1.87 sec		5.0	4.0		Pre-Running			Pre-Running		KAMI/CKM parasitic
September shutdown 4 weeks												
												Shared (NuMI&Kaon&BTeV)



MIPP planning



task	FY02				FY03				FY04				FY05			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Meson Detector Building																
Beamline in MC6																
Meson Worm (MC7) prep																
Upstream Beam Detect.																
Jolly Green Giant																
Rosie																
Differential Cerenkov																
Targets																
TPC																
Time of Flight																
Ring Imaging Cerenkov																
Drift Chambers																
Calorimeter																
Trigger																
Data Acquisition																
Data Taking																
Data Analysis																

Numi/MINOS
Running



MIPP sub-system points of contact



Beam Cerenkovs	M.Heffner	LLNL
Target Wheel	Jerry Peterson	U.Colo.
TPC	P.Barnes/Ron Soltz	LLNL
Cerenkov	D.Wright	LLNL
Chambers	E.Hartouni	LLNL
ToF	S.Mishra	U.So.Carolina
RICH	E.Swallow	Elmhurst C./EFI
Calorimeter	M.Longo	U.Mich.
DAQ	R.Soltz	LLNL
Monte Carlo	R.Raja	FNAL
Installation	L.Beverly	FNAL



Proposed data run schedule



Engineering run	2 weeks
1% targets	14 weeks
Cryo-targets	12 weeks
NuMI target	2 weeks

Assume “double slow spill” running mode.

Note that NuMI target running includes 2 sets of data with 1×10^7 events each using a 120 GeV/c proton beam. Incident beam position and angle are measured. Beam emittance includes anticipated NuMI conditions.



Specific NuMI needs



NuMI target
Carbon targets
Other targets

what is an acceptable target?
1% target will be run, need others?
Be target data?

Initial data analysis consists of momentum and particle identification reconstruction, as well as a tuned Monte Carlo.

MINOS collaborators currently involved with MIPP are: LLNL, U.So. Carolina, Enrico Fermi Institute (EFI), and Harvard U.



Accelerator issues



“Double slow spill” running needs to be demonstrated with the Main Injector.

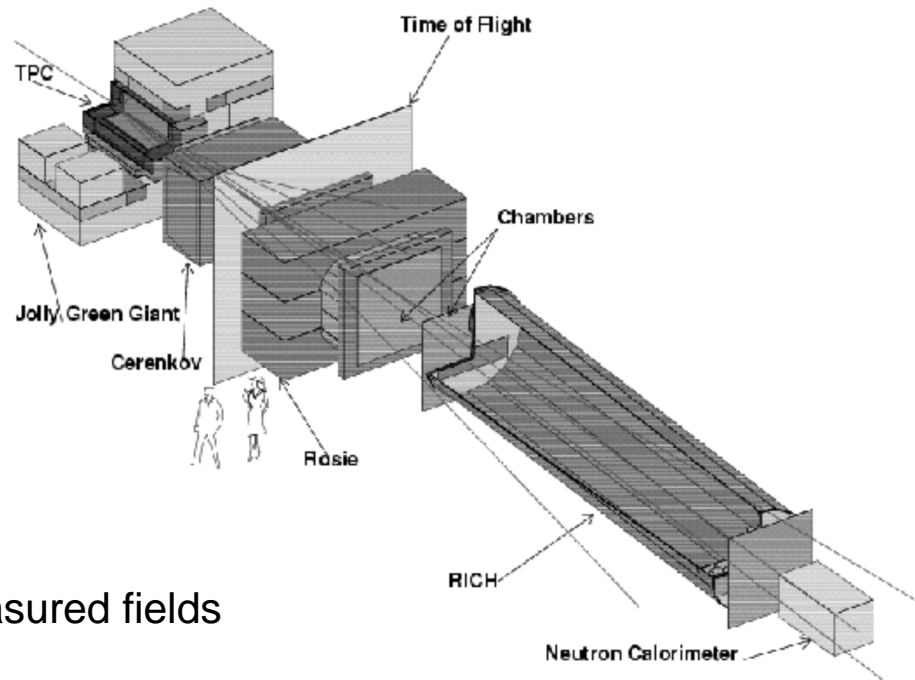
- 1) Inject 2 booster batches in the Main Injector.**
- 2) At start of “flat top” extract 1 batch to p-bar accumulator.**
- 3) “Slow spill” the second batch to the Meson area, using roughly 10% of the batch.**
- 4) At the end of the slow spill period, extract remaining batch to p-bar accumulator.**

This preserves p-bar production rate with a period of 3 seconds and a small loss of intensity to Run IIA.

MIPP has time to run *before* MINOS, should not be a factor in “proton economy” of NuMI run.

MIPP

Main Injector Particle Production Experiment (FNAL-E907)



- Magnets with measured fields
- TPC
- Chambers
- Threshold cerenkov
- Time of Flight (model)



Invitation and conclusion



MIPP welcomes participation of interested physicists, and groups to join in with the preparations, running and analysis of the particle production data.

There are still many opportunities to make significant contributions.

Many more details are available at the URL:

<http://ppd.fnal.gov/experiments/e907/>